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UTILIZING FORAGE From Improved Pastures

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SUMMARY

Improved pastures can provide some of the most economical farm-grown nutrients for livestock. For this to be possible, use of pasture forage must be managed so that plants are efficiently grazed or harvested when nutritious, but are protected from damage by overuse. This requires skillful management of the timing and intensity of forage use, based on thorough knowledge of both plants and livestock.

Three modern systems of pasture forage utilization--rotation grazing, strip grazing, and green feeding--provide guidelines and patterns that can aid in bringing about efficient forage use.

The three systems were developed to meet different requirements in the use of forage. They have certain features in common. No one system can be said to answer the needs of every farm. All three generally are used to accomplish a common purpose: As an aid in bringing about maximum net dollar returns from pasture and livestock.

This report describes the three systems, notes some of their limitations and possibilities, and points up the important role of effective management in their successful use.

Information for this report was provided by the Dairy Cattle Research Branch, Animal Husbandry Research Division, and the Forage and Range Research Branch, Crops Research Division.

UTILIZING FORAGE FROM IMPROVED PASTURES

Livestock are wasteful in their grazing habits. Instinctively, they search out the most palatable plants and plant parts--literally the cream of the pasture crop--and are inclined to avoid less palatable forage.

Recognizing this, farmers and scientists have searched for ways to encourage livestock to eat more of the forage that is available to them from pastures, thus cutting down on waste and increasing the efficiency of forage use. One way this has been done is through use of various systems that help control the availability of forage to livestock.

Three forage utilization systems that have evolved in recent years are rotation grazing, strip grazing, and green feeding. These systems can be used not only to encourage forage consumption by livestock, but also to protect plants from overgrazing and other damage.

The systems provide patterns for grazing and harvesting forage that are designed for efficient and practical management of improved grasslands. Their successful operation depends on skillful judgment that is based in turn, on an intimate knowledge of both plants and livestock.

Highly important to the success of the systems is the ability of farmers to recognize signs of inefficient forage use and to correct conditions that bring them about. These signs show up in either plants or livestock, or both. They can be avoided if grazing or harvesting is started and ended at the correct time and stage of plant growth, if the proper numbers and kinds of livestock are grazed on an area, and if plants are provided sufficient opportunity to recover before grazing or harvesting is repeated.

Skill in making these management decisions is actually the key to efficient use of pastures. With good management, it is possible to use forage efficiently with any of the utilization systems. Rotation grazing, strip grazing, and green feeding provide ways for reinforcing managerial skill with such features as planned plant rest periods and a high degree of control over grazing and harvest.

No single system of forage utilization fits all farming situations. Each farm has its own set of requirements and such factors as animal and seasonal needs for forage should be carefully considered before selecting a system.

Increasing Livestock Production With Forage

There may be a number of ways that livestock production can be increased with forage on a particular farm. These include: (1) Increasing the forage potential of a pasture through use of more productive plants and better cultural methods and by intelligent use of different plant species that mature at different times during the season; (2) decreasing waste of

forage during grazing, harvesting, and feeding; (3) decreasing damage to plants from trampling or overuse; and (4) by combining two or more of these possible changes.

Pasture with a high forage yield potential is the starting point for high animal production per acre. Efforts to improve production through grazing management may be fruitless if pastures are poor. Skillful management becomes increasingly important as pastures are made more productive, because the possibilities of wasteful use and damage to plants are also increased. Dense, fast growing plants are particularly vulnerable to damage from trampling and over-grazing.

DEVELOPMENT OF MODERN FORAGE UTILIZATION SYSTEMS

Modern systems for utilizing forage resulted from research and practical experience. Dating from 1930, scientists and farmers made some of the most significant contributions toward improving pastures and their use. Refinements were made in pasture fertilization, irrigation, and other cultural practices. Plant breeders developed better pasture plants. As these were released to growers, more and more land was seeded to adapted, highly productive grasses and legumes. Annual, biennial, and semi-permanent pastures gained places of prominence alongside permanent pastures.

Interest also centered on improving methods of grazing and harvesting pasture forage. Dairy farmers, in particular, attempted to find better ways to utilize forage, extend grazing periods, and obtain more uniform levels of milk production. Some of them experimented with a grazing method developed in Germany called the Hohenheim system. Designed especially for dairy cattle, it involved heavy fertilization. Pastures were divided into smaller grazing areas and cattle were permitted to graze the areas in rotation.

The Hohenheim system was the forerunner of modern rotation grazing. The rotation system was first used with bluegrass and other low-growing plants in permanent pastures. Later, it was found to fill an important requirement in grazing improved pastures containing erect, highly productive new species of grasses and legumes. Unlike low-growing plants, these new species proved to be especially sensitive to overgrazing and continuous grazing. The rotation system provided a way to control grazing so that the highly productive plants could be protected.

Strip grazing is a variation on rotation grazing that has been used in New Zealand and Australia for over two decades and for a shorter period in the United States. With this system, livestock are moved onto a new strip of pasture each day.

Green feeding is a modern version of a system of cutting and hand feeding fresh forage that was first used in this country more than 150 years ago. With the present system, livestock never enter the pasture, but forage is harvested by machine and brought to them.

ROTATION GRAZING

The rotation grazing system provides a way to utilize forage by confining livestock to an area so small that they will eat all pasture plants to a

desired height in a given period of time. When grazing is completed on an area, plants are allowed to establish new growth before being grazed again. These rest periods help prevent destruction of highly productive grasses and legumes.

Maintenance of desirable pasture plants as well as more efficient utilization of forage are the two major factors that contribute to the efficiency of rotation grazing. The individual contribution of these two factors is usually difficult to determine.

Rotation grazing helps to reduce damage to forage from trampling, which can cause great waste in dense, tall crops if grazing is poorly managed. Cattle in rotationally grazed pastures usually obtain the forage they require in less time than cattle on pastures grazed continuously and therefore conserve energy for meat and milk production.

Because pastures are alternately grazed and left idle during rotation grazing, such jobs as fertilization, clipping for weed control, and irrigation can be done on areas not in use without the interference of grazing livestock. For the same reason, excess forage can easily be harvested for hay or silage, thereby, in effect, temporarily reducing the area required for grazing. This permits considerable flexibility in the number of animals that can be grazed on an area during the season.

From the standpoint of management, rotation grazing is relatively simple to use. A pasture is divided into several grazing areas with electric fence. The number of grazing areas, size of the areas, and livestock numbers are adjusted so that each area is grazed to a height that best maintains the seeded species, and the time for plant rest periods is geared to the growth rate of the pasture.

Plant growth rate varies during the season, a factor that will regulate both the number of grazing livestock and the size of the grazing areas. During the period of flush plant growth in the spring, for example, it may be impossible to move animals through all pasture areas and adequately graze each area. Surplus forage maybe harvested for hay or silage. Later, as the rate of plant growth slows down, animals may graze through all areas at a relatively rapid pace.

Livestock are usually turned onto the first area as soon as they can get a "good bite", or at the earliest time compatible with the animals obtaining a reasonable amount of forage, yet not damaging desirable plant species.

During the first round of grazing in the spring, livestock are permitted to progress through the pasture areas, grazing forage down to the recommended height, until the area on which grazing was first begun has recovered sufficiently to be grazed again. The animals are then moved back to this area and the areas untouched during the first round of grazing are cut for hay or silage.

Milk production may fluctuate during the period dairy cows are grazing an area of pasture under the rotation system. Production may be at a high level for a few days after the animals are turned onto an area, then slacken after the more nutritious plants are eaten, usually reaching its lowest point just before the cows are moved to a new area. This cyclic pattern of production usually does not lower total seasonal milk production.

A variation on conventional rotation grazing, called the split-herd system, is sometimes used with dairy cattle. The herd is divided into low and high producers, and cattle are rotated through grazing areas so that high producers are first to be turned onto a new area. They remain on the area for a short period of time, usually a week or less, then are moved to another new area. The low producers then are moved onto the pasture area partially grazed by the high producers.

The split-herd system gives high-producing cattle the advantage of being first to graze nutritious new pasture growth. Theoretically, the quality of forage they consume is consistently high. ARS studies indicate that some increase in milk production may be expected from this system, compared with conventional rotation grazing, provided that sufficiently large differences in milk-producing capabilities exist between the high- and low-producing groups of cows.

STRIP GRAZING

Strip grazing is a method of intensified rotation grazing that provides smaller grazing areas and shorter grazing periods. Livestock are moved onto new forage each day, helping to lessen the chance of fluctuations in animal production such as those sometimes experienced with conventional rotation grazing.

There appears to be no convincing evidence that strip grazing will result in appreciably greater animal production or more cow-days of grazing per acre than a well-managed rotation grazing system. In comparisons of strip and rotation grazing in which the number of animal units permitted to graze an area were kept equal, total seasonal animal production from pastures under the two systems was identical.

Strip grazing is more complicated than rotation grazing because of the chore of moving livestock to a fresh strip of pasture each day. Most farmers use a single strand of electric fence that can be readily shifted from strip to strip.

Bloat is less likely to occur during strip grazing than during continuous or rotation grazing because the more limited grazing area encourages cattle to eat coarse, more mature forage along with the bloat-causing immature, leafy portions of legumes.

When dairy cattle are strip grazed on pastures at the Agricultural Research Center, Beltsville, Md., the width of pasture strips is adjusted each day so that forage is well utilized. This involves daily observation of both livestock and pasture to determine if the animals are receiving adequate forage and if there is damage to the pasture stand. As the cattle progress through the pasture, forage on ungrazed areas that obviously will not be needed for grazing is harvested for hay or silage.

Clipping of pasture areas is recommended. This practice helps control weeds, removes clumps of uneaten forage, and promotes young and nutritious forage growth. Hay and silage may be made from any pasture area if excellent growing conditions cause a surplus of plant growth for grazing.

GREEN FEEDING

The green feeding system is also called soiling, green chop, mechanical grazing, zero pasture, and zero grazing. As some of these terms indicate, pasture forage is harvested with machinery, rather than livestock. This way, energy normally used by livestock for grazing is used in meat and milk production.

Green feeding is an adaptation of a method of cutting and feeding forage crops first used in this country in the early 1900's to supplement pastures. The early system never became generally popular because it was complex, involved much hand labor, and the growing of a succession of crops throughout the season.

Interest in feeding fresh cut forage revived with the development of high-yielding forage crops and such labor-saving machinery as field forage choppers and self-unloading wagons.

Equipment and labor requirements are still relatively high with the modern system of green feeding because forage is cut, chopped, and fed once or twice daily. On the other hand, the need for fencing, watering facilities, shade, and other requirements associated with grazing is reduced or eliminated.

A dairy herd of at least 35 to 40 cows is required to make green feeding economical.

The principal advantage of green feeding is the possibility of meeting forage needs with fewer acres than would be required with grazing. The system helps avoid waste caused by selective grazing, trampling, or fouling with droppings for two reasons: (1) livestock never enter the fields, and (2) both leaves and stems of plants are harvested and fed.

The prospect of reducing acreage requirements for forage is especially attractive on farms where operating costs are high, labor is plentiful, and where land for pasture is scarce. However, green feeding of improved pasture forage has seldom resulted in more animal products per acre than well - managed rotation grazing when animals have been allowed equal time to utilize the crop. Production per animal has also been about equal in such comparisons.

In some cases, the success reported with green feeding has resulted from not only changing the forage utilization system, but also from changing from low-yielding to high-yielding forage crops. Studies in which ladino clover-orchardgrass forage was utilized either by rotation grazing, strip grazing, or green feeding, showed no advantage in animal production that favored green feeding over the other systems.

A high degree of crop management skill is necessary for successful operation of green feeding. Excellent management is required to produce a continuous succession of crops and to harvest and feed them during their most nutritious stage of growth.

Generally, green feeding involves more risks than a grazing system. Machinery breakdowns and rainy weather can slow down or prevent daily harvest. Some risks can be offset by providing emergency pasture near

feedlots or by having an emergency supply of hay or silage. Other factors related to green feeding, but not to grazing systems, include hauling of manure from feedlots, the need for surfaced feedlots, and sanitation and disease problems that may occur as a result of confining livestock to drylot.

THE ROLE OF MANAGEMENT IN FORAGE UTILIZATION

Determination of the best way to improve livestock production through better use of forage is a complicated process because two biological systems are involved; livestock and the pasture plants. Every decision about one in some way affects the other. Understanding certain basic interrelationships that exist between plants and livestock is important in making forage management decisions. The better these interrelationships are understood, the greater are the possibilities of making effective decisions.

The forage utilization system selected for a farm should result in maximum net dollar returns from pasture and livestock. To accomplish this, it would appear that the ideal system should provide the highest possible animal production by the use of all forage that grows in a pasture. In practice, however, top animal production is possible when livestock consume only the most nutritious plants in the pasture and avoid coarse, more mature plants. This is the pattern of wasteful selective grazing cattle instinctively follow if not controlled. When livestock are compelled to eat all plants in the pasture, the overall nutritive value of the forage they consume is lowered by the mature forage plants and weeds it contains. The result is less-than-maximum animal production.

In the interest of efficiency, it is good management to compromise between obtaining maximum animal production and the using of all forage in a pasture. This compromise is accomplished through management decisions that avoid excessive waste of forage and damage to the pasture from overuse without sacrificing animal production unnecessarily to favor pasture growth. They result in a pasture utilization plan that takes into account the fact that various ages and classes of livestock have different forage requirements and the fact that ample forage should be available throughout the season, including critical production periods.

Decisions About Intensity of Pasture Use

Successful forage management decisions effect a satisfactory balance between the capacity of a pasture to produce quality forage and the capacity of livestock to produce meat or milk. This balance is mutually beneficial to the plants and livestock. In the final analysis, such management decisions involve the determination of a correct stocking rate for grazing (animal days of grazing per acre) or a correct rate of harvest for green feeding.

Accurate rates for stocking or for harvesting take into account individual animal differences. This requires an intimate knowledge of the productive capacities of the animals.

Livestock differ in their inherited capacities to produce meat and milk. Some animals may eat more forage than they can possibly convert

into animal products. Others may make efficient use of a relatively high intake of forage, supplemented with concentrates, because of their inherited high capacity for production.

There also are seasonal variations in the productive capacities of pastures. A special problem occurs during the period of flush plant growth in the spring, when livestock usually cannot eat all of the forage that is available. This problem may be solved by reducing the size of the pasture area grazed and by harvesting excess forage for silage or hay, or by increasing the number of livestock grazing the pasture.

Signs of Inefficient Pasture Use

Signs of inefficient pasture use are most likely to develop when livestock are permitted to graze a pasture continuously with a minimum of control. The animals are free to follow their natural tendencies to select only palatable, tender leaves and plants and to avoid more mature and less palatable plants.

The signs are characterized by areas of over-mature forage, areas of extremely short forage that has been frequently and closely grazed, and changes in the pasture stand from more productive to less productive species and weeds.

Close observation of both pasture and livestock can result in early detection of the signs of inefficient pasture use. Rotational and strip grazing generally result in closer management than continuous grazing. Condition of both pasture and livestock may be observed regularly as animals are moved from area to area. Danger signs may be noted and adjustments made in the size of grazing area or the length of grazing period.

Green feeding provides an opportunity for close regulation of the use of pasture forage, since it makes possible strict control over the entire operation. Harvest may be done in a manner that prevents plant damage and waste. In addition, daily contact with livestock permits adjustments in the amount of forage fed to achieve a desired level of animal production.

Rest Periods for Plant Recovery

The rest periods for plant recovery that are an integral part of rotation and strip grazing and green feeding help bring about a balance between production and consumption of forage. Used correctly, they protect pastures from overuse and help assure that enough nutritious forage will be available to livestock throughout the pasture season.

Managing forage in such a way as to include adequate rest periods has become an important feature of the three pasture systems because the plants predominant in improved pastures are especially sensitive to close, continuous grazing or frequent harvesting. These plants are more erect and more productive than the low-growing plants in permanent pastures and include such legumes and grasses as ladino clover, alfalfa, the fescues, Coastal bermudagrass, dallisgrass, orchardgrass, bromegrass, and timothy.

Because of their height, a larger amount of the leaf surface of plants in improved pastures may be easily eaten or trampled by livestock. Loss of leaf surface is a setback to plants. Leaves that are removed ordinarily would be used to manufacture carbohydrates for continued growth and reserves stored in roots. When defoliated, plants rely on root reserves, and continuous defoliation results in depletion of these reserves and death of the plants. If grazed too frequently and too close, the improved plants may be forced out of the pasture stand, often to be replaced by weeds.

During rest periods, forage plants produce new foliage from shoots near the ground. This foliage is highly digestible and high in protein content. When regular rest periods are provided, the plants will continually produce new shoots and the foliage remains young and nutritious. New foliage has a very high vitamin A value because it is rich in carotene. It is also rich in B-complex vitamins, vitamin E, ascorbic acid, and certain other essential vitamins. Calcium and phosphorus contents also are higher than in mature forage.

Livestock generally prefer young plants, or the young and actively growing leaves and stems of plants. In their search for these, they will pass by more mature plants. This selective grazing may be a special problem when grazing is continuous and poorly controlled. On the other hand, the greater degree of control of forage use provided by rotation grazing, strip grazing, and green feeding minimizes the problem by compelling livestock to eat all plants and plant parts. Production of high-producing animals may suffer, however, if they are compelled to eat low-quality forage.

The Importance of Timing

Management involves determining when grazing should be started, how long it should be continued on each pasture area, and when and how often forage should be harvested for green feeding.

The maturity, leafiness, and yield of forage at the time it is grazed or harvested are important in determining the feeding value of any pasture crop. Best yields of nutritious forage are obtained when plants are young, vegetative, and actively growing. In this stage, the plants are more palatable, more nutritious, and more digestible than when they are mature.

Grazing should be started in the spring as soon as livestock can obtain an adequate amount of forage, yet not damage the plant stand. Rotation grazing may be continued on each pasture area until such mixtures as bromegrass and alfalfa are grazed to a minimum average height of 3 to 4 inches, and mixtures such as orchardgrass and clover are grazed to an average height of 2 inches. During hot, dry weather, however, these minimum heights should be raised an inch or more. The size of strip-grazed pasture areas should be so adjusted that the forage is grazed to the minimum height desirable for the plants at the end of a 24-hour period.

The sequence for chopping for green feeding should be so timed that forage is cut when nutritious and adequate recovery periods are provided between harvests. Cutting for green feeding generally should be started when plants are in the early hay stage, which occurs a week or more after the plants are ready for grazing.

FITTING THE FORAGE UTILIZATION SYSTEM TO THE FARMING SITUATION

Properly managed, each of these three improved forage utilization systems can advance the efficiency of livestock production. But which of the three systems will best meet farmers' needs, can only be determined by evaluating their relative merits and drawbacks in terms of individual farming situations.

To be taken into account are such basic considerations as type of livestock enterprise, herd size, available pasture land, terrain, and climate. Add to these such items as land values, personal credit, and a farmer's holdings in livestock production facilities and equipment. Finally, the system selected must take into account the background, training, and skill of the producer himself --- in brief, his abilities to make the managerial decisions inherent in the success of each of the systems.

There is no reason to believe that the advantages and disadvantages of the three systems are static. Characteristics of systems that limit their use today may be overcome by the development of new machinery and techniques for harvesting and feeding, and new grazing techniques. A growing population with its greater demands for food can increase land values to a point where farmers will wish to meet forage requirements with fewer acres of land intensively grazed or harvested.

The relative positions of the systems also could be changed by development of new forages that will increase forage productivity per acre or by development of techniques that help make highly productive annual forage plants as inexpensive to grow as biennial or perennial forage plants.

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